

**CLAIMS:**

1. A device for removing an aliquot of biological sample from a sealed  
5 receptacle comprising said sample, comprising:
- a) a hollow chamber of predefined volume having inner and outer  
walls and top and bottom ends;
  - b) a hollow piercing tip having sharp and blunt ends, wherein the  
blunt end is engaged to the bottom end of the hollow chamber; and
  - 10 c) a filter barrier engaged to the inner walls of the hollow chamber.
2. The device of claim 1, wherein the piercing tip is retractable within said  
hollow chamber.
- 15 3. The device of claim 1, wherein said biological sample is blood, plasma,  
spinal fluid, serum, saliva, sputum, urine, feces, Buccal cells, spermatozoa, solid tissue,  
bacteria, yeast, viral samples, semen, cultured cells lines, plants, and combinations  
thereof.
- 20 4. The device of claim 1, wherein said sealed receptacle is a sample tube.
5. The device of claim 1, wherein the pipette tip and/or the piercing tip is  
disposable.

6. The device of claim 1, wherein the filter barrier is a hydrophobic sterilizable filter barrier.

7. The device of claim 1, wherein said aliquot is from about 1 $\mu$ l to about 5ml in volume.

8. The device of claim 1, wherein said aliquot is from about 5 $\mu$ l to about 1ml in volume.

9. The device of claim 1, wherein said aliquot is from about 20 $\mu$ l to about 100 $\mu$ l in volume.

10. A method for removing an aliquot of a biological sample from a sealed receptacle comprising said biological sample, comprising the steps of:

- a) piercing said sealed receptacle with a device comprising a hollow chamber of predefined volume having inner and outer walls and top and bottom ends; a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber; and filter means engaged to the inner walls of the hollow chamber for preventing cross-contamination of fluids, aerosols, or samples beyond said hollow chamber; and
- b) aspirating a predefined volume of said biological sample into said hollow chamber.

11. The method of claim 10, wherein the piercing tip is retractable within said hollow chamber.

5 12. The method of claim 10, wherein said biological sample is blood, plasma, spinal fluid, serum, saliva, sputum, urine, feces, Buccal cells, spermatozoa, solid tissue, bacteria, yeast, viral samples, semen, cultured cells lines, plants, or combinations thereof.

13. The method of claim 10, wherein said sealed receptacle is a sample tube.

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14. The method of claim 10, wherein the removal of said sample from said sealed receptacle comprising said sample is automated.

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15. The method of claim 10, wherein the pipette tip and/or the piercing tip is disposable.

16. The method of claim 10, wherein the filter barrier is a hydrophobic sterilizable filter barrier.

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17. The method of claim 10, wherein said aliquot is from about 1 $\mu$ l to about 5ml in volume.

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18. The method of claim 10, wherein said aliquot is from about 5 $\mu$ l to about 1ml in volume.

19. The method of claim 10, wherein said aliquot is from about 20 $\mu$ l to about 100 $\mu$ l in volume.

20. A sampling tube system for removing an aliquot of a biological sample from a sealed sample tube comprising said biological sample, comprising:

- a) a loading arm comprising at least one inflatable membrane holder for reversibly engaging said sample tube for aspiration of the biological sample from the sample tube;
- b) a transfer arm comprising a positioning element reversibly engaged to the loading arm for rotating the loading arm and inverting said sample tube;
- c) a pipette tip reversibly engaged to the transfer arm comprising a filter barrier, a hollow chamber of predefined volume and a piercing tip for piercing said sample tube;
- d) an aspiration tube affixed onto said pipette tip for aspirating said biological sample once the piercing tip has pierced said sample tube; and
- e) optionally, a pipette strip holder for holding said pipette tips.

21. The sampling tube system according to claim 20, wherein the transfer arm rotates and moves the loading arm to sample multiple tubes in serial or in parallel.

22. The sampling tube system according to claim 20, wherein said sample tube is located on a sample rack.

5 23. The sampling tube system according to claim 20, wherein the sample rack comprises a carousel housing between 1 to 32 tubes.

24. The sampling tube system according to claim 20, wherein said aliquot is from about 1 $\mu$ l to about 5ml in volume.

10 25. The sampling tube system according to claim 20, wherein said aliquot is from about 5 $\mu$ l to about 1ml in volume.

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15 26. The sampling tube system according to claim 20, wherein said aliquot is from about 20 $\mu$ l to about 100 $\mu$ l in volume.

27. A method for sampling one or more biological samples from sealed sample tubes comprising said biological samples, comprising the steps of:

- 20 a) transferring said sample tube from a sample rack to a loading arm, wherein said sample tube is in an upright position;
- b) piercing said sample tube with a pipette tip comprising a piercing tip;

- c) inverting the pierced sample tube to a degree sufficient to maintain contact of the sample and the closure for a time sufficient to allow sample collection;
- d) aspirating said fluid from the pierced sample tube into a chamber within the pipette tip;
- e) reinverting the pierced tube to the upright position; and
- f) withdrawing the piercing tip from the sample tube.

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28. The method of claim 27, wherein said sample tube is held firmly in place by said loading arm by inflatable membrane holders.

29. The method of claim 27, wherein said sample tube is sealed with a closure.

30. The method of claim 27, wherein said sample rack is a carousel having between 1 to 200 tubes.

31. The method according to claim 27, wherein said sample rack contains between 1 to 32 tubes.

32. The method of claim 27, wherein said aliquot is from about 1 $\mu$ l to about 5ml in volume.

33. The method of claim 27, wherein said aliquot is from about 5 $\mu$ l to about 1ml in volume.

34. The method of claim 27, wherein said aliquot is from about 20 $\mu$ l to about 100 $\mu$ l in volume.

35. A device for removing an aliquot of a biological sample from a sealed receptacle comprising said biological sample, comprising:

- a) a hollow chamber of predefined volume having inner and outer walls and top and bottom ends;
- b) a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber;
- c) a filter barrier engaged to the inner walls of the hollow chamber;
- d) a side vent positioned within the hollow chamber and between the filter barrier and piercing tip; and
- e) a deflector plate separating the hollow chamber and the side vent;

wherein the deflector plate substantially prevents or blocks excess sample from entering into the side vent.

36. The device of claim 35, wherein the piercing tip is retractable within said hollow chamber.

37. The device of claim 35, wherein said biological sample is blood, plasma, spinal fluid, serum, saliva, sputum, urine, feces, Buccal cells, spermatozoa, solid tissue, bacteria, yeast, viral samples, semen, cultured cells lines, plants, or combinations thereof.

5 38. The device of claim 37, wherein said sealed receptacle is a sample tube.

39. The device of claim 37, wherein the pipette tip and/or the piercing tip is disposable.

10 40. The device of claim 37, wherein the filter barrier is a hydrophobic sterilizable filter barrier.

41. A device for removing an aliquot of biological sample from a sealed receptacle comprising said biological sample, comprising:

- 15 a) a hollow chamber of predefined volume having inner and outer walls and top and bottom ends;
- b) a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber;
- c) a filter barrier engaged to the inner walls of the hollow chamber;
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- d) a side vent positioned within the hollow chamber and between the filter barrier and piercing tip;



wherein the blunt end of the piercing tip substantially prevents or blocks excess sample from entering into the side vent.

42. The device of claim 41, wherein said aliquot is from about 1 $\mu$ l to about  
5 5ml in volume.

43. The device of claim 41, wherein said aliquot is from about 5 $\mu$ l to about  
1ml in volume.

44. The method of claim 41, wherein said aliquot is from about 20 $\mu$ l to about  
10 100 $\mu$ l in volume.

45. The device of claim 41, wherein the piercing tip is retractable within said  
hollow chamber.  
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46. The device of claim 41, wherein said biological sample is blood, plasma,  
spinal fluid, serum, saliva, sputum, urine, feces, Buccal cells, spermatozoa, solid tissue,  
bacteria, yeast, viral samples, semen, cultured cells lines, plants, or combinations thereof.

47. The device of claim 41, wherein said sealed receptacle is a sample tube.  
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48. The device of claim 41, wherein the pipette tip and/or the piercing tip is  
disposable.

49. The device of claim 41, wherein the filter barrier is a hydrophobic sterilizable filter barrier.

5 50. A device for removing an aliquot of a sample from a sealed receptacle comprising said sample, comprising:

- a) a hollow chamber of predefined volume having inner and outer walls and top and bottom ends;
- b) a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber; and
- c) a filter barrier engaged to the inner walls of the hollow chamber.

10 51. A sampling tube system for removing an aliquot of a sample from a sealed sample tube comprising said sample, comprising:

- a) a loading arm comprising at least one inflatable membrane holder for reversibly engaging said sample tube for aspiration of the sample from the sample tube;
- b) a transfer arm comprising a positioning element reversibly engaged to the loading arm for rotating the loading arm and inverting said sample tube;
- c) a pipette tip reversibly engaged to the transfer arm comprising a filter barrier, a hollow chamber of predefined volume and a piercing tip for piercing said sample tube;

- d) an aspiration tube affixed onto said pipette tip for aspirating said sample once the piercing tip has pierced said sample tube; and
- e) optionally, a pipette strip holder for holding said pipette tips.

5           52. A method for sampling one or more samples from sealed sample tubes comprising said samples, comprising the steps of:

- a) transferring said sample tube from a sample rack to a loading arm, wherein said sample tube is in an upright position;
- b) piercing said sample tube with a pipette tip comprising a piercing tip;
- c) inverting the pierced sample tube to a degree sufficient to maintain contact of the sample and the closure for a time sufficient to allow sample collection;
- d) aspirating said fluid from the pierced sample tube into a chamber within the pipette tip;
- e) reinverting the pierced tube to the upright position; and
- f) withdrawing the piercing tip from the sample tube.

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- a) a hollow chamber of predefined volume having inner and outer walls and top and bottom ends;

- b) a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber;
- c) a filter barrier engaged to the inner walls of the hollow chamber;
- d) a side vent positioned within the hollow chamber and between the filter barrier and piercing tip; and
- e) a deflector plate separating the hollow chamber and the side vent;

wherein the deflector plate substantially prevents or blocks excess sample from entering into the side vent.

54. A device for removing an aliquot of sample from a sealed receptacle comprising said sample, comprising:

- a) a hollow chamber of predefined volume having inner and outer walls and top and bottom ends;
- b) a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber;
- c) a filter barrier engaged to the inner walls of the hollow chamber; and
- d) a side vent positioned within the hollow chamber and between the filter barrier and piercing tip;

wherein the blunt end of the piercing tip substantially prevents or blocks excess sample from entering into the side vent.

55. A method for preventing cross-contamination of an aliquot comprising a sample while removing said aliquot from a sealed receptacle comprising said sample, comprising the steps of :

- a) piercing said sealed receptacle with a device comprising a hollow chamber of predefined volume having inner and outer walls and top and bottom ends; a hollow piercing tip having sharp and blunt ends, wherein the blunt end is engaged to the bottom end of the hollow chamber; and filter means engaged to the inner walls of the hollow chamber for preventing cross-contamination of fluids, aerosols, or samples beyond said hollow chamber; and
- b) aspirating a predefined volume of said sample into said hollow chamber.

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